NORMAL BOWEL PATTERN IN CHILDREN AND DIETARY AND OTHER PRECIPITATING FACTORS IN FUNCTIONAL CONSTIPATION

DISSERTATION SUBMITTED FOR

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CERTIFICATE

This is to certify that dissertation titled, **''Normal bowel pattern in children and dietary and other precipitating factors in functional constipation''** Submitted by Dr.Balamma Sujatha to the faculty of Pediatrics, The Tamilnadu Dr.M.G.R Medical University, Chennai, in partial fulfillment of the requirements for the award of M.D. Degree (Pediatrics) is a bonafide research work carried out by her under our direct supervision and guidance, during the academic year 2008-2011.

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DECLARATION

I **Dr.Balamma Sujatha,** solemnly declare that the dissertation titled ‘‘**Normal bowel pattern in children and dietary and other precipitating factors in functional constipation’’** has been prepared by me. This is submitted to the **Tamilnadu Dr. M.G.R. Medical University,** Chennai in partial fulfillment of the rules and regulations for the M.D. Degree Examination in Pediatrics.

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CONTENTS

INTRODUCTION

In day to day pediatric practice about 10 % of children present with constipation; and 10 % to 25 % of referrals to pediatric gastroenterologist are for constipation[1]. Although often regarded as a less common and insignificant problem by many physicians, chronic constipation is of great importance to the child and his family. The early and accurate assessment and prompt treatment of constipation is vital to the child's well being and life style. Delay in management will only exacerbate the problem and perpetuate the child's lack of self esteem. As there is no published data on childhood constipation from Southern India, we conducted this study from one the largest tertiary referral center for pediatrics from Southern India.

Definition

Constipation is a symptom, not a disease. Different patients have different perceptions of symptoms. Some patients regard constipation as straining (52%), while for others, it means hard, pellet-like stools (44%) or an inability to defecate when desired (34%), or infrequent defecation (33%).

The definition of functional constipation as per the **Rome III Diagnostic Criteria for FGIDs** (Functional gastrointestinal disorders)

Must include one month of ***at least two*** *of the following in infants up to 4 years of age:*

1. Two or fewer defecations per week
2. At least one episode/week of incontinence after the acquisition of toileting skills
3. History of excessive stool retention
4. History of painful or hard bowel movements
5. Presence of a large fecal mass in the rectum
6. History of large diameter stools which may obstruct the toilet

Accompanying symptoms may include irritability, decreased appetite, and/or early satiety. The accompanying symptoms disappear immediately following passage of a large stool[2].

Background

FGIDs especially constipation are common morbidity factors in otherwise healthy persons as well as in patients with various predisposing diseases. In the general population, constipation is frequently reported, resulting in 2.5 millions of physician visits in the United States[3] and a total health care cost of $2752 per patient treated[4]. The high prevalence rates,

economic cost and adverse implications on the quality of life and health state, [5&6] make constipation a major public health issue.

Normal bowel function

Meconium is passed within the first 24 hours in about 87% of infants and within 48 hours by 99%; this is not influenced by whether the infant is receiving breast milk or formula[7]. Subsequently, however, the method of feeding has a significant impact on stool frequency, color and consistency. Breast-fed infants pass softer, uniformly yellow stools up to five times a day. This is more frequent than in bottle-fed infants. However, breast-fed infants may occasionally have no bowel actions for 3 days or more, which is rare in bottle-fed infants. Within the first few weeks of life, 64% of breast-fed, but only 30% of bottle-fed infants are having more than three bowel movements a day[7&8]. Stool frequency reduces progressively with age, so that by 16 weeks of age both breast-fed and bottle-fed infants are passing on average two stools a day. Weaning children between 4 and 6 months of age, results in a firmer stool [9].

Physiology

Defecation is a complex process involving a coordinated activity of the abdominal and pelvic musculature (straining) and relaxation of anal

sphincters. It is triggered by achieving a threshold distension of the lower rectum with stool. Once continence has been achieved, defecation can be inhibited by voluntary contraction of the external sphincter. Boys take slightly longer time for toilet training than girls, but complete bowel control is achieved at a mean age of 37 months[10]. By pre-school age, 96% of children on a low-fibre diet have a bowel action within the range of three times a day to every alternative day[8, 11]. The cause of constipation in the pediatric population can be categorized as due to either an anatomic or a physiologic impediment to defecation. Anatomic causes include Hirschsprung's disease, imperforate or malpositioned anus, illeal atresia, meconium illeus or a colonic stricture. Physiological causes include hypothyroidism, spinal cord defects, prune-belly syndrome, lead poisoning, infant botulism and the most common cause for constipation - Functional constipation syndrome. Functional constipation is a self perpetuating condition that arises from voluntary withholding or decreased colonic motility. This condition occurs when the rectal vault continues to distend with stool without formal defecation. Eventually, the normal physiological urge to defecate is lost. Most children with functional constipation voluntarily withhold secondary to pain on defecation as a result of anal fissure or the passage of large, hard stools. Often in the older child, the

environment plays a crucial role, as many children develop constipation because they will not use public rest room.[12] Encopresis has been found to occur in 1% to 2 % of children[13]. It is characterized as soiling of at least 1 month duration. Encopresis is three to four times more common in boys, and this condition is an aberration of the complex blend of behavioral and physiologic factors in children[12].

Epidemiology of constipation and faecal soiling

Definitions of constipation vary in children, a stool frequency of less than three times per week, passage of hard painful stools, periodic passage of very large amounts of stool at least once in every 7-30 days, or a presence of palpable abdominal or rectal mass on physical examinations are considered abnormal[14]. Faecal soiling occurring at least once a week and persisting beyond the age of toilet training can also indicate constipation. Soiling may occur with or without associated faecal retention. Constipation in childhood is common, with reported prevalence ranging from 0.3% to 28%,[15,16] but it is much more frequent when dietary fibre intake is restricted[17]. Faecal soiling occurs in 1%–3% of children aged 4-7 years[17]. At school age, more boys than girls (ratio, 3 : 1) have constipation and this is functional in nature (i.e., without objective evidence of a pathological

condition)[18]. About 80% of children with functional constipation will be successfully treated within 5 years. Success is less likely when constipation first presents before the age of 12 months, or in children with associated faecal soiling [15]. A significant proportion (30%–50%) of children will relapse after being successfully treated for constipation (with or without soiling), and there is evidence that they do not improve on reaching puberty[14, 19].

Etiology of constipation in children

1. **Functional**

2. **Anatomic**

   Anorectal malformations

   Strictures

   Tumours

3. **Neurogenic conditions**

   Hirschprungs disease

   Cerebral palsy and development retardation

   Myelodysplasia

   Spinal cord trauma

Neurofibromatosis

Intestinal neuronal dysplasia and other neural visceral neuropathies

Botulism

Spinal muscular atrophy

Prune belly syndrome

4. **Systemic and metabolic disorders**

Electrolyte abnormalities (hypokalemia, hypercalcemia)

Hypothyroidism

Cystic fibrosis

Diabetes mellitus

Malabsorption

Coeliac disease

Multiple endocrine neoplasia type 2 B

5. **Drugs**

Opiates

Anticholinergics

Tricyclic antidepressants

Anticonvulsants

Antacids and sucralfate

Lead ingestion

Iron

Vitamin D intoxication

6. Diet

Inadequate dietary fiber and fluid[20].

The etiology of constipation and soiling in childhood is multi-factorial[21]. Painful defecation has been proposed as the primary precipitant of functional faecal retention in early childhood, although the cause of these painful bowel actions is not clear [15, 22]. Functional faecal retention is characterized by voluntary withholding of stool. Childhood constipation appears to be a significant problem in West due to diminished fibre intake and reduced exercise. Hard bowel movements may precede stool toileting refusal,[10] perhaps leading to a self-perpetuating cycle. Subsequent rectal dilatation is then associated with impaired rectal sensation and motor function[23]. Faecal soiling is likely to occur during spontaneous relaxation of the sphincters precipitated by rectal distension[24] .

In older children, difficulty in evacuating stool may be associated with abnormal contraction of the anal sphincters and pelvic floor during attempted defecation (anismus), which may develop from earlier voluntary withholding behavior. Slowed colonic transit as a cause of constipation in childhood is also well recognized, as is the association of low fibre intake with hard, infrequent stools. Although extreme restrictions of physical activity and reduced fluid intake can be associated with constipation, these are not usually important factors in most children with constipation. It has recently been recognized that one of the manifestations of cow's milk protein allergy in early childhood is constipation. These children typically first present in the second or third year[25,26].

Clinical presentation of constipation

Constipation in the first week of life, presenting as delayed passage of meconium beyond the first 48 hours, suggests either an anatomical obstruction, such as anal atresia or stenosis, or Hirschsprung's disease. In the next few months, before weaning, bottle-fed infants tend to pass harder stools and may present with difficult passage of hard stools, and occasionally with a fissure. Breast-fed infants are less likely to pass hard stools, but very infrequent stools in these infants may raise parents' concern

about whether this is normal. Constipation may also first present at the time of weaning onto solids in both breast-fed and bottle-fed infants. Toilet training for stool may be associated with the development of withholding behavior and functional faecal retention. Behavioral problems can lead to struggles over toilet training, and the child may start refusing to use the toilet despite being previously successfully trained. Some children are happy to pass urine in a potty but refuse to pass stool at the same time, only passing stool in a nappy. While seated on the potty or toilet, these children may lean back to clench their buttocks and prevent passage of stool. They may also exhibit withholding behavior when ambulant, crossing their thighs or walking on tiptoe to clench their buttocks. Up to 63% of children with constipation and faecal soiling will have a history of painful defecation beginning before 3 years of age and secondary withholding behavior. Parents will typically report a child who strains at stool but cannot pass more than a small amount[27]. Often children may present with diarrhea or abdominal pain as the initial complaint[12].

Physical examination and investigations

Apart from the routine aspects of the physical examination, it is important to determine whether the child's development is within normal

limits for his or her age. A brief nutritional assessment is found useful. The physical examination should focus particularly on the abdomen, spine and perineum. The abdominal examination reveals whether there is a significant colonic mass. Of all children with significant constipation, about half will have palpable abdominal stool[28]. A neurological examination should include the spine as well as lower limbs and the saddle area to assess whether sensation and reflexes are normal. An anorectal examination enables exclusion of anatomical abnormalities, such as anal stenosis, as well as traumatic injury. It also allows assessment of sphincter tone and the presence of stool. (However, repeated "routine" rectal examinations are likely to add little information and may distress the child.) The presence of firm, packed stool in the rectum correlates closely with radiological evidence of faecal retention, with sensitivity and positive predictive values exceeding 90%[29]. An abdominal x-ray is only likely to be useful if no significant faecal retention is found on rectal examination. There can be considerable inter observer variation among radiologists in scoring x-rays for faecal retention[30]. Agreement is more likely with a large amount of retained faeces. Barium studies are of little or no value in most children with constipation, as they do not add any further information.

Anorectal manometry provides an understanding of the pathophysiological abnormalities underlying the child's constipation. However, it is only available in a few specialized centers. About 95% of children with functional constipation will have an abnormality on manometric examination (e.g., impaired sensation to rectal distension, abnormal contraction of the external anal sphincter and pelvic-floor muscles during straining for defecation, or inability to defecate the rectal balloon [28].

Management of children with constipation

Education

It is important to spend time at the initial consultation with both child and parents in order to explain that constipation and faecal soiling are common and are likely to improve with age and simple therapies. The easiest way to explain soiling is to emphasize the loss of conscious awareness of the need to defecate that comes with chronic rectal distension with faeces. Episodes of faecal incontinence are likely to be due to involuntary relaxation of the sphincters triggered again by rectal distension. This emphasis on the importance of "keeping the rectum empty" is likely to alleviate blame, and improve cooperation and compliance[31].

Disimpaction

Children who present with significant faecal retention should have a "clean-out" of the colon[31]. Softening agents and stimulant laxatives, taken orally, are usually preferred, although there may be some advantage in the concurrent use of enemas. A regimen for disimpaction is given in infants who develop constipation before toilet training and best treated with a softener such as lactulose (5-15 ml once daily). Liquid paraffin should be avoided in infants under the age of 6 months, as well as in those with frequent regurgitation, or when there is concern about aspiration. Hypertonic phosphate enema preparations should be avoided in children because of the risk of significant electrolyte disturbance[31].

Maintenance therapy

The crucial aspect of long-term maintenance therapy is establishing a regular toileting regimen, generally about two to three times a day for 5-10 minutes at a time after meals, with the child being praised for complying. It is important to ensure appropriate toileting posture and comfortable foot support with the feet flat. Behavior modification can be documented in a toileting diary, which is used to record toileting frequency (usually with a tick), successful passage of stool in the toilet and soiling-free days (with a

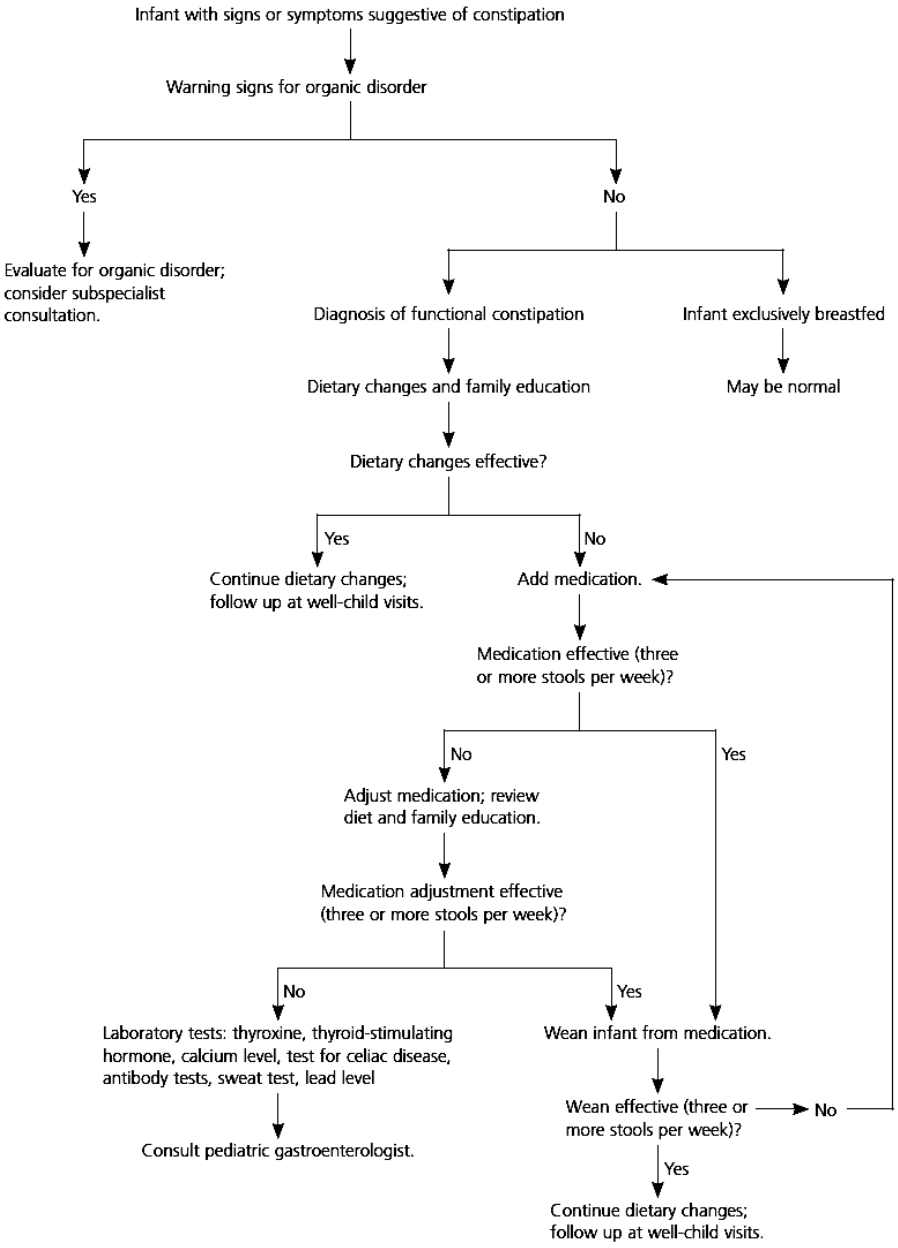
star), daily medications, and episodes of soiling. Stool reimpaction is less likely to occur if stools are being passed daily[31]. Most parents ask about diet, and there is evidence that increasing dietary fibre increases the frequency of bowel actions in children[32]. If dietary fibre is deficient, then this should be optimized. The American Academy of Pediatrics (AAP) recommends a daily dietary fibre intake for children of 0.5 g/kg body weight, up to 35 g/d[33]. Minimum daily fibre intake equivalent to age in years plus 5 g/d for children older than 2 years is usually recommended[34]. There is little evidence to support the use of fibre in excess of recommended intakes in children. Dietary changes are unlikely to be helpful if the main mechanism of constipation is withholding behavior. Laxatives are used to help children produce a soft, regular stool, and provide additional benefit compared with behavioral therapy alone[35]. They are most useful when children are unable to comply with a regular toileting regimen. A combination of a stool softener (e.g., paraffin or lactulose) with a stimulant laxative (e.g., bisacodyl) is often more successful than either used alone.

Other therapy options

Biofeedback has been promoted as an effective therapy for children with anismus, but there is no evidence that it has any benefit over behavioral

therapy and the use of regular laxatives[36]. Biofeedback is often very useful in adults.

Management flow chart for functional constipation



REVIEW OF LITERATURE

Vikrant Khanna et al; from the department of pediatric gastroenterology Sanjay Gandhi postgraduate institute of medical science Lucknow India did a study to analyze the etiology, clinical spectrum and outcome of constipation in children. In their study 85% of children had functional constipation while the remaining 15% had an organic disorder. The organic group had delayed passage of meconium and abdominal distension as compared to functional group. Fecal impaction (69%), straining (35%), withholding behavior (27.4%), and fecal incontinence (30.8%) were common in functional group[37].

Wald E.R, et al; did a study on the normal bowel pattern of children. They did an analysis on the bowel habits and toilet training in a diverse population of children. They gathered data concerning bowel habits and toilet training of developmentally normal children ages 5 to 8 years. In their study population toilet training started at a mean of 27.2 months and was completed at a mean of 32.5 month. Girls trained 3 months earlier than boys in an average. 95% of children defecated daily or every other day. Straining at defecation and infrequent stooling were reported significantly more often for girls, while staining of underclothes and passage of large bowel

movements were reported more often in boys. About 10% of children fulfilled criteria for functional constipation[38].

Weaver L.T and ***Steiner H*** from University Department of Child health, Royal Victoria Infirmary, Newcastle upon Tyne, performed a study on the bowel habits of young children. 350 children from a single general practice were studied. According to their study they found that all children ate a predominantly low fiber, mixed diet. 85% had bowel movements once or twice a day. 96% had bowel movement every day to every other day. At all ages stools were sausage type predominantly and only < 10% produced grape sized stools. Consistency of stools was soft most of the time. Those children who opened their bowels less than once a day produced significantly harder stools 0.9% of children had passed blood in their stools. 19% of these opened their bowels less than once a day compared with only 4 % of those children who had never passed blood[11].

KS IP et al; department of pediatrics and adolescent medicine, Pamela Youde Nethersole Eastern hospital, Chai Wan, Hong Kong conducted a study on community based study of the prevalence of constipation in young children and the role of dietary fiber. The result obtained in their study was that 29.6% of children were constipated. The

incidence of family history of constipation was significantly higher in the constipated group (14%) than in non constipated group. Mean dietary fiber consumption was 4.1 g/day corresponding to 45.5% of the daily recommendation. Constipated children had a significantly lower dietary fibre intake of the daily recommendation than the non-constipated group[39].

Giuseppe Iacono, et al; a study on the effect of cow's milk allergy in constipation. They performed a double-blind study, crossover study comparing cow's milk with soy milk in 65 children with chronic constipation. In their study they found that 45 of the 65 children (68%) had a response while receiving soy milk. None of the cow's milk had a response. Children with a response had a higher frequency of coexistent rhinitis, dermatitis, or bronchospasm than those with no response. Anal fissure and erythema was also more common in this group. Signs of hypersensitivity, such as specific IgE antibodies to cow's milk antigens was more in this group. The authors conclude that in young children, chronic constipation can be a manifestation of intolerance of cow's milk[26].

Lundblad B and Hellstorm AL in his study on 386 Swedish school children aged 6 to 16 years using a semi structured questionnaire in 2001, questioned regarding the availability of toilet paper, soap, cleanliness, and

foul smell. The author concludes that many children influenced by negative perceptions of school toilets have adopted unhealthy toilet habits during school time. For many children, toilet visit away from home can create a psychological strain. Thus, children often find it easier to endure physical discomfort of not relieving themselves rather than the psychological and social discomfort of using a school toilet. This could have an adverse effect on bladder and bowel function of children[40].

Maartje M. Van den Berg, et al; from the department of pediatric gastroenterology and nutrition Amsterdam, Netherlands did a systematic review of the published literature to assess the prevalence, incidence, natural history, and co morbid conditions of functional constipation in children. The prevalence of childhood constipation in the general population ranged from 0.7% to 29%. Variance of gender specific prevalence was reported in seven studies and five of seven studies reported no significant difference between boys and girls. The age group in which constipation is most common could not be assessed with certainty. Socio economic conditions were not found to be associated with constipation[41].

Stephen M. Borowitz, et al. from the department of pediatrics and behavioral medicine, University Virginia health sciences center studied the

precipitants of constipation during early childhood from 125 families visiting their primary care physician for the first time with a child aged between 2 and 7 years with the complaint of constipation. In the study the authors found that constipated children in comparison to control children did not have a parent or sibling with a history of constipation. They did not begin toilet training earlier than did control children. Parents reported more difficulties with toilet training in constipated children. Parents of constipated children indicated their children had more difficult and more painful defecation experiences than did parents of control children. In conclusion the authors say painful defecation is the primary precipitant of constipation during early childhood. Parents should be counseled to be attentive to such experiences and taught to intervene quickly to lessen the risk that their child will develop persistent constipation or fecal soiling[15].

George Peppas in his study ‘‘A systematic review of Epidemiology of constipation in Europe and Oceania’’ reviewed 21 studies and found a mean value of reported constipation rates as 17.1%.Female gender, age and socioeconomic and educational class seem to have major effect on constipation prevalence. In one of the study the prevalence of constipation

was 6.3% for the 1st class to a considerably higher 10.2% for the 5th class. In another study low maternal education level is considered as a factor significantly associated with increased odds for constipation in children[42].

Vera Loening-Baucke carried out a retrospective review of case records of all children, 4-17 years of age, seen for at least one health maintenance visit during a 6 month period and followed from birth or within the first 6 months of age in their clinics. All charts were reviewed for constipation, fecal incontinence and urinary incontinence. They found that the prevalence rate of constipation was equal in boys and girls and was 22.6%. 18 % were functional and the remaining 4.6% acute in onset. The prevalence for fecal incontinence was 4.4% and it was associated with constipation in 95% of cases. Prevalence rate for urinary incontinence was 10.5%. Both fecal and urinary incontinence were significantly more common in children with constipation and boys with constipation had more fecal incontinence than girls[28].

Lima S.M from the department of pediatrics, Hospital Sao Miguel, Oliveira Azemeis, Portugal did a retrospective study of children with the diagnosis of encopresis. 44 children were included in the study and they

found a male predominance 80%. Frequent signs encountered were abdominal mass (68%), fecal impaction (72%) and fecal retention (75%)[43].

Ludvigsson JF; Abis Study Group. From the department of pediatric, Orebro University Hospital, Sweden conducted a prospective cohort study on children born between 01.10.97-01.10.99 with respect to socioeconomic factors, infant sex, smoking vs. constipation, diarrhea, anorexia, abdominal pain and vomiting using logistic regression. It was found that constipation correlated with low maternal education, female sex, living in a large community and having no older siblings[44].

Simeone D et al; a study on the prevalence of atopy in children with chronic constipation, from the department of pediatrics, University of Naples evaluated 91 children with chronic constipation 69 of them fell into the atopy study age range. 12 of the 69 in constipated group had atopy. The elimination diet of milk for 4- week trial did not result in improvement in any of the children[45].

Freddy T.M et al; from the department of pediatric gastroenterology Amsterdam, the Netherlands. Did a randomized control trial on dietary fiber mixture versus lactulose in the treatment of childhood constipation. There

was no difference between the groups after the treatment period concerning defecation frequency and fecal incontinence frequency. But the consistency of stools was softer in the lactulose group. Abdominal pain and flatulence scores were comparable. Taste scores and the need to step up medication were comparable[46].

Guideline for the management of pediatric idiopathic constipation and soiling by ***Barbara Felt et al;*** after identifying references on the best path to early, accurate diagnosis; best methods for adequate clean out; and best approaches to promote patient and family compliance with management the authors developed an algorithm and clinical care guideline for pediatric idiopathic constipation and soiling management[47].

Nathan J et al; conducted a study to determine whether constipation and painful defecation occur as a result of stool toileting refusal or occur before this behavior is not known. Results showed that mean age at the completion of daytime toilet training was 36.8 ± 6.1 months. 34.4% children developed stool toilet refusal (STR). These children experienced more hard bowel movements, and painful defecation. 93.4% demonstrated constipation before onset of STR[10].

W .Henderson of York hospital says that rectal inertia may develop by too much emphasis placed by parents on the need for regularity in obtaining bowel movement, or perhaps too strict a discipline imposed in an effort to get the infant clean in its habits at an early age. The maximum age of presentation is probably 6 years but ranges from 3 to 9 years. The age of onset of symptom is always earlier about 2 years. It is more common in boys than girls. The child can present with fecal soiling or apparent fecal incontinence. In many cases there is recurrent abdominal discomfort[48].

Croffie M.J from Indiana, USA says that there is intentional withholding of stool in most constipation. This could occur due to change from human milk to cow milk which could lead to firmer stools and hence painful defecation in an infant. Coercive or inappropriate toilet training in a toddler not ready for toilet training may lead to withholding and passage of dry hard stools, anal fissures and painful defecation. In older children the tendency to withhold may develop from situation that make defecation uncomfortable or inconvenient such as unpleasant toilet facilities at school or anal pain due to sexual abuse or streptococcal anusitis[49].

Iacono et al; in 1999 from Italy did a prospective follow-up study of birth cohort with a sample size of 2879. In their study the prevalence of

constipation was 17.6% with a prevalence of constipation in boys 17.3% and 17.9% in girls[50].

Miele E et al; another study from Italy which was a prospective study based on questionnaire in June 1999 on childhood constipation using ROME II criteria, found the prevalence of constipation to be 0.7%[51].

Kajiwara et al; 2002 from Japan reported prevalence of constipation to be 18.5% with a prevalence of 13.2% in boys and 24.2% in girls from a school sample using parent / subject questionnaire[52].

Kokkonen et al; 2004 from Finland found the prevalence of constipation to be 1.5% from a school sample of 404 using parent questionnaire[53].

Coraziarri et al; 2005 from Italy found a prevalence of constipation of 2.6% in the age group of 0-12 using parent / subject interview[54].

Ciampo D et al; 1996-1997 from Brazil found the prevalence of constipation to be 26.8% with sex wise split showing a prevalence of 26.1% in boys and 27.6% in girls[55].

Roma et al; 1999 from Greece a study on the general population in children of age group 2-14, found the prevalence of childhood constipation to be 15%[56].

In 2003 ***Uguralp S et al;*** a study from a Turkey school with sample of 1377 children in the age group 5-9 using parent questionnaire and found the prevalence of constipation to be 12.4%[57].

Pecora P et al; 1981 from Italy found the prevalence of constipation to be 16.7% in the age group 6-12[58].

Blum NJ et al; from USA in 2004 did a prospective follow-up phone interview of 378 children with age range of 17 to 19 months from a general pediatric clinic and observed 17.3% of constipation in those children[10].

Kalo BB and ***Bella H*** from Saudi Arabia in 1996 did a study in school children aged 6-16 years, using parent questionnaire and the incidence of constipation was 9.1% in their study[60].

Yong D and ***Beattie RM*** from United Kingdom did a study on school children 4-11 years of age. The prevalence of constipation was 4.7% in their study population[61].

Issenman RM et al; a Canadian study followed up through phone interview a birth cohort of 215 children from 1983-1985 in the age group 22-40 months reported 6.5% prevalence rate of constipation in the studied population[62].

Bhaskar Raju B in a review article on constipation concludes that functional constipation is the most common cause of constipation and accounts for about 97% of all constipation. Good history and thorough physical examination including per rectal are all that is required to diagnose functional constipation. Laxative therapy is needed for several months. Early withdrawal of therapy leads to relapse. Effective therapy depends on child and family education, adequate disimpaction and maintenance phase[63].

JUSTIFICATION OF THE STUDY

Constipation is a common problem encountered in office practice. Although clinical profile of such children is well documented from the west, the same has not been described from the developing world. There is a scarcity of Indian literature on this topic. The normal bowel pattern in Indian children is virtually unknown. At present no study is available from southern India. Our centre being the largest tertiary care pediatric center, this study has been undertaken to analyze the normal bowel pattern in south Indian children along with to identify the predisposing factors in children with functional constipation, which is the most common cause of constipation.

AIM OF THE STUDY

1. To study the normal bowel pattern of children with respect to their food habits and collect data regarding psychosocial aspect of toileting issues.

2. To study the diet pattern, psychosocial aspect and clinical profile of children with habit constipation.

MATERIALS AND METHODS

Study design:

Prospective descriptive study

Study place:

Pediatric Gastroenterology outpatient department, Institute of child health and hospital for children, Egmore, Chennai.

Study period:

May 2009 to November 2010

Study population:

1. Functional constipation group: Children with functional constipation, in the age group of 2-12 years, of either sex who attended gastroenterology outpatient department of Institute of child health.

2. Normal bowel pattern group:

   i) School children aged 6-12 year of either sex from two different schools catering to different socioeconomic group.

ii) 2-5 year old children attending outpatient department of ICH for other minor ailments of both sexes.

Inclusion criteria:

Children with functional constipation who attended Gastroenterology OPD of ICH Egmore, who fulfilled the criteria for functional constipation according to Rome III criteria.

Exclusion criteria:

Children already on treatment for functional constipation and children with organic causes of constipation were excluded from the study.

MANEUOVER

After getting clearance from the Institutional Review Board and the ethical committee, the study was undertaken from April- 2009.

1. Consecutive children with functional constipation attending the gastroenterology department of ICH fulfilling the ROME III criteria were included in the study from April 2009-November 2010. The demographic profile, socioeconomic status, presenting complaints, psychosocial aspects affecting normal bowel pattern behavior, like

temper tantrum, marital disharmony, sibling rivalry, school phobia, aversion to use school toilet were collected and recorded in a prestructured proforma (Annexure I). The diet pattern of these children were also recorded in a diet chart (Annexure III), concentrating on the regularity of breakfast, vegetable and fruit intake, junk foods in the form of baked or fried items and regarding the consumption of milk. Stool frequency and type of stool passed was recorded for a period of one week, with Bristol stool chart being the reference for type of stool passed. The proforma were filled by parents.

2. Similarly data from school children aged between 5 to 12 years of either sex were collected from two schools catering to different socioeconomic groups. These data were filled up by parents after getting consent from the respective principals and parents in a proforma in the regional language and in English were applicable in a prestructured proforma (Annexure I).

3. Children aged between 2 to 5 years attending the outpatient department of Institute of Child health and Hospital for children, for minor ailment were also included in the study. The data collected

from them was similar to the one collected from school children and was recorded in a prestructured proforma (Annexure I).

4. The data's from both groups were analyzed and compared using SPSS version 15 for windows. Categorical data were expressed as absolute counts and percentages. Continuous data were expressed as medians and interquartile range. Data were considered statistically significant at $p<0.05$. For variables in qualitative form, chi square test was used in the univariate analysis to observe the association between the study variables and the outcome.

OBSERVATIONS

Out of 131 children with functional constipation 65 were girls and boys were 66. The male female ratio was 0.98: 1. The mean age in years of the study group was 5.18. The mean age of girls and boys were 5.08 years and 5.16 respectively. The standard deviation was 3.085.

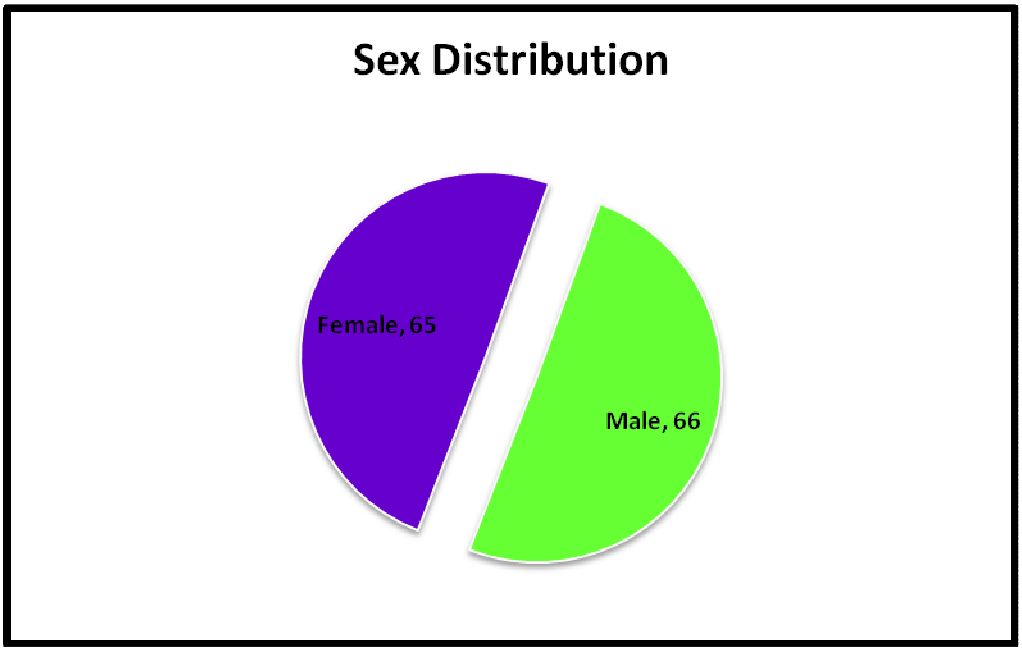


Chart - 1

Table-1: Distribution of age and sex of Functional constipation

Age in Years	Boys (%)	Girls (%)	Total (%)
2-4	42 (32)	33 (25.1)	75 (57.25)
5-7	10 (7.6)	10 (7.6)	20(15.26)
8-10	10 (7.6)	17(12.9)	27(20.61)
11-12	4 (3)	5 (3.8)	9 (6.88)
Total	**66(50.3)**	**65 (49.6)**	**131 (100)**

The highest number of children presenting with constipation was in the age group of 2-4 years. The least number of children were from 10-12 years. In the initial 7 years constipation was more common in boys. As age of presentation increases, the number of girls with constipation increase as compared to boys.

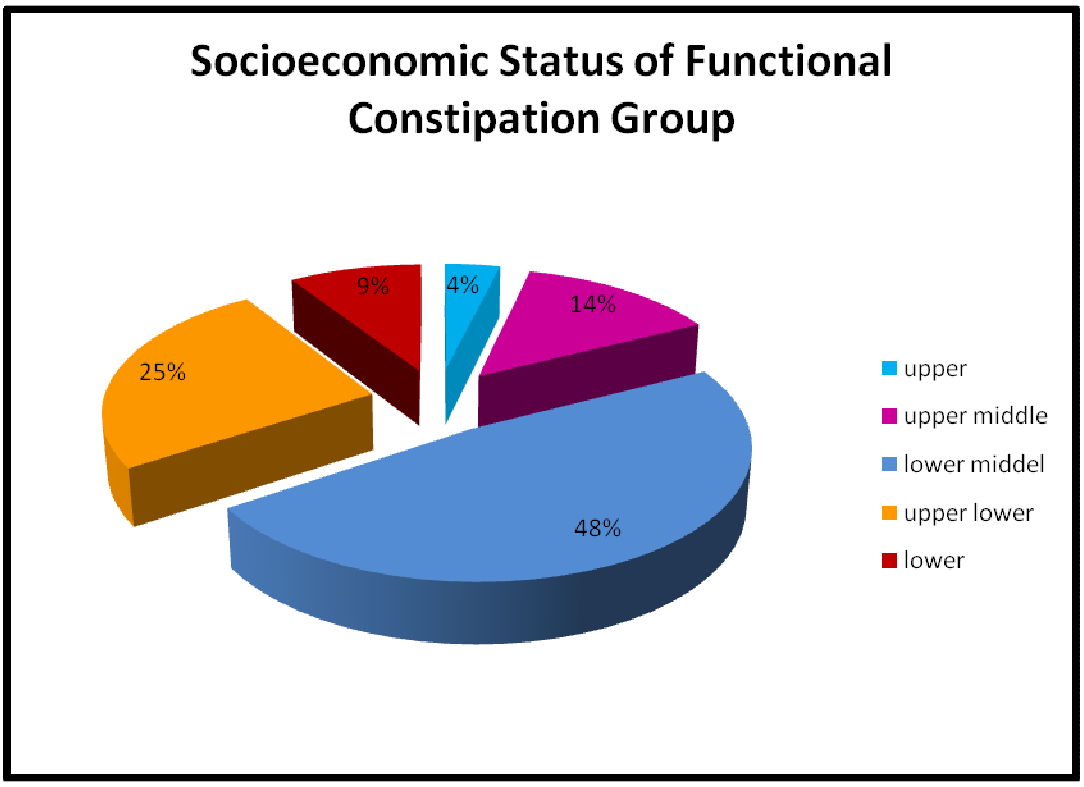


Chart - 2

Out of the 131 children with functional constipation, the highest number belonged to lower middle class, 63 (48%). The next group with highest number of children was upper lower, with 33 (25%). The rest of the children were distributed among upper middle class, 18 (14%), lower class, 12 (9%) and the least number of children were from upper class, 5 (4%).

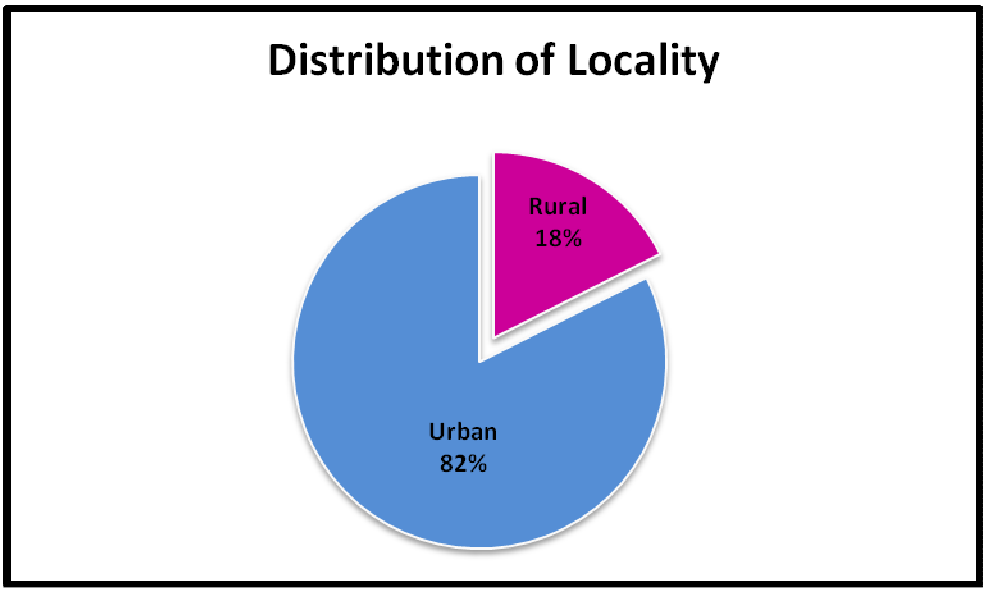


Chart - 3

The number of children from rural area were 23 (17.5%) and the rest of 108 (82.5%) belonged to urban locality in the functional constipation group.

Table-2: Type of family in functional constipation group

Type of Family	**Total Number n=131(%)**
Nuclear	99 (75.5)
Joint	29 (22.1)
Separated	3 (2.2)

In the functional constipation group 99 (75.5%) of children lived in nuclear family, 29 (22.1%) in joint family and 3 (2.2%) of them were in separated families.

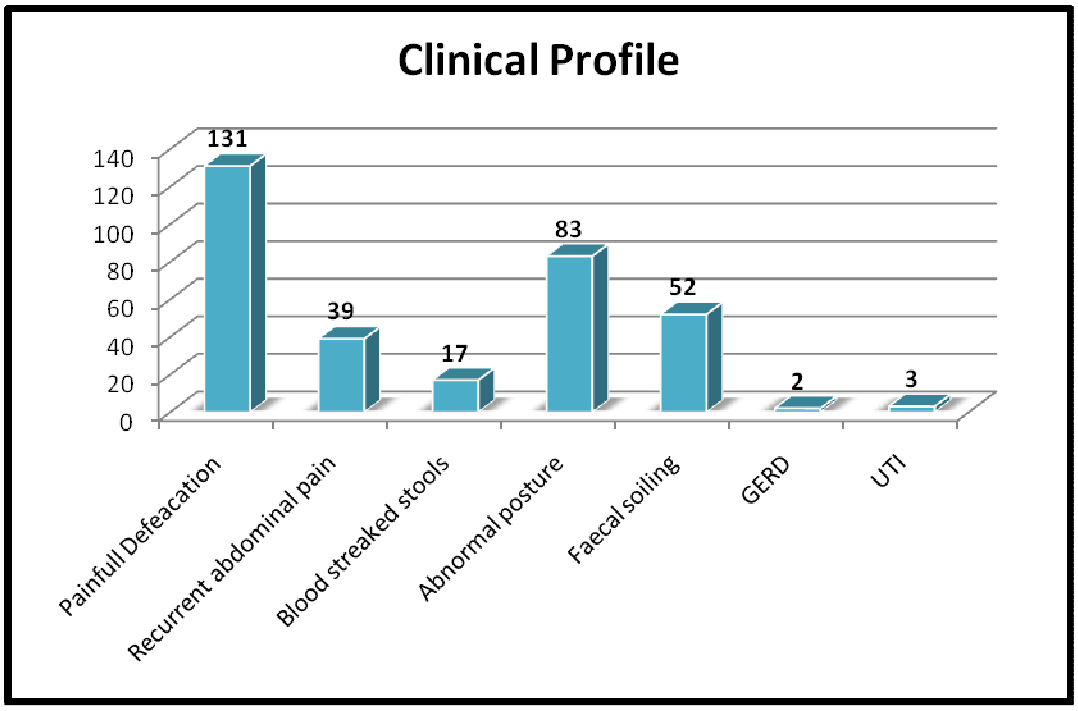


Chart - 4

83 (63.4%) of functional constipation children had retentive behavior in the form of abnormal posturing. Abnormal posturing was more common in the age group of 2-4 (n=61) and the age it was most frequent was the second year n=28 (33.7%). Boys manifested this symptom more often than girls, n= 47 (56.6%).

Fecal soiling was the present in 52 (40.4%) of children. It was present equally in girls and boys n= 26.

Recurrent abdominal pain as the presenting complaint was present in 39 (29.7%) of children. This symptom was slightly more common in girls n=21 as compared to boys n=18.

Urinary symptoms were present in 3 children with habit constipation and all of them were girls.

Blood streaked stools was present in 17 (12.9%) children. This was not the presenting symptom in most of them but was elicited during history taking.

Typical Gastro esophageal reflux symptoms were present in 2 (1.5%) children with functional constipation.

Bowel Habits

110 (83.9%) of children had stool frequency of <3 per week. Out of which 35 of them had stool frequency of one per week and 75 of them passed stools twice in a week.

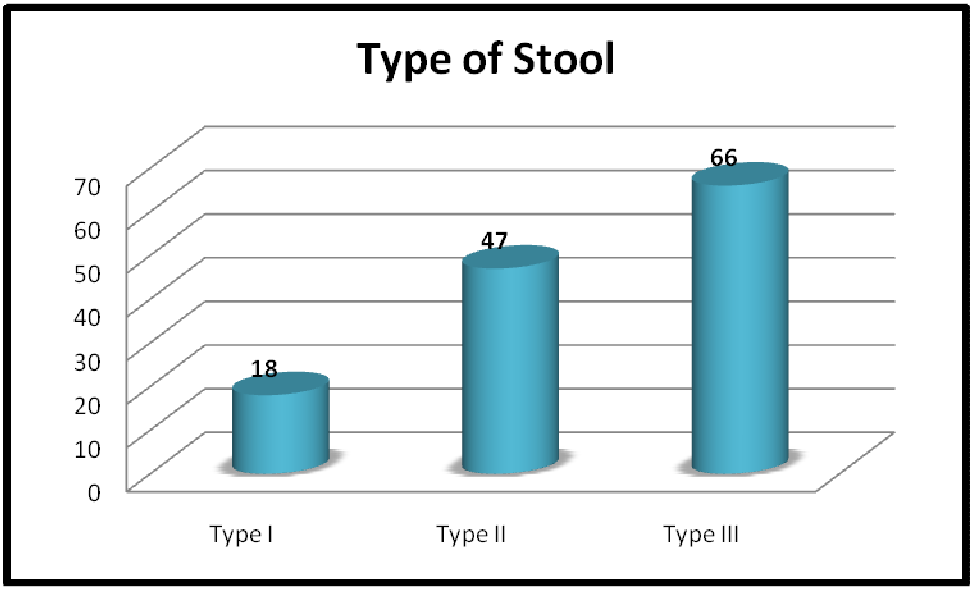


Chart - 5

The stool type in them was type I in 18 (13.7%) and type II in 47 (35.8%) and type III in 66 (50.3%) according to the Bristol stool chart.

Children who passed stools more than 3 times per week n=21(16.1%) had pellet like stool with incomplete bowel emptying. The average stools passed per week in this group is 2.5.

Psychological Precipitants

Toilet training was started from as early as 5 months to 36 months of age. Most of the children were started on toilet training (n=92, 70%) between 12 to 18 months. The mean age at which toilet training was started was 15.5 months in the constipated group.

The location of the toilet was indoor in 47 (35.8%) and outdoor in 84 (64.2%).

Table-3: Psychological Precipitant factors in functional constipation group

Precipitant	**Percentage (%)**
Marital Dysharmony	23.6
Sibling Rivalry	23.6
Temper tantrum	61.8
School phobia	9.9
Aversion to use school Toilet	28.2

Marital disharmony and sibling rivalry was present equally in the functional constipation group, with 31 children (23.6%) in each group. Temper tantrum was present in 81 (61.8%) of children with constipation.

School phobia was present in 13 (9.9%) and unwillingness to use the school toilet was present in 37 (28.2%) children.

The average time to start to school was 25 minutes. 36 of children started more than 30 minutes before school bell.

20 (15.2%) children's mothers in the functional constipation group were working parent.

Diet:

Predominantly children had rice based food. Milk was consumed by 96 (73.2%) of the children out of which 16 (12.2%) had cow's milk. Vegetables and fruits intake was adequate in 27 (20.6%) and 24 (18.3%) of children respectively. Junk foods in the form of fried items and baked items formed 47 (35.8%) and 88 (67.4%) of children. Breakfast was skipped by 24 (18.3%) of children.

Normal bowel pattern results

A total of 523 children were analyzed for normal bowel pattern. The mean age of children in this study population was 6.9 years with a standard deviation of 2.5. Out of which the numbers of girls was 287 (54.9%) and their mean age was 6.9 years. The number of boys was 236 (45.1%) and the mean age for boys was 6.9 years. The male female ratio was 0.82: 1.

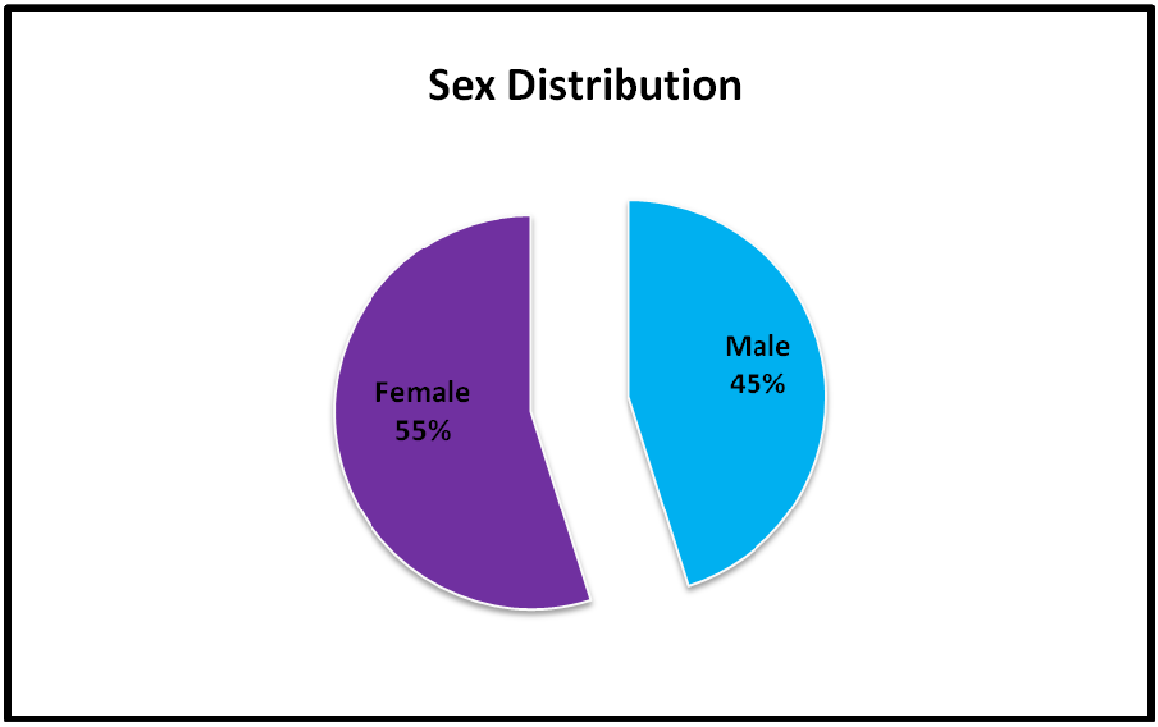


Chart – 6

Table-4: Distribution for age and sex of population under investigation

Years	Boys	Girls	Total (%)
2-4	46	63	109 (20.84)
5-7	81	86	167 (31.94)
8-10	99	130	229 (43.78)
11-12	10	8	18 (3.44)
Total	**236**	**287**	**523**

The distribution of girls and boys were almost equal in each age group. Out of the 523 children, 53% of them belonged to the age group of 2-7 years.

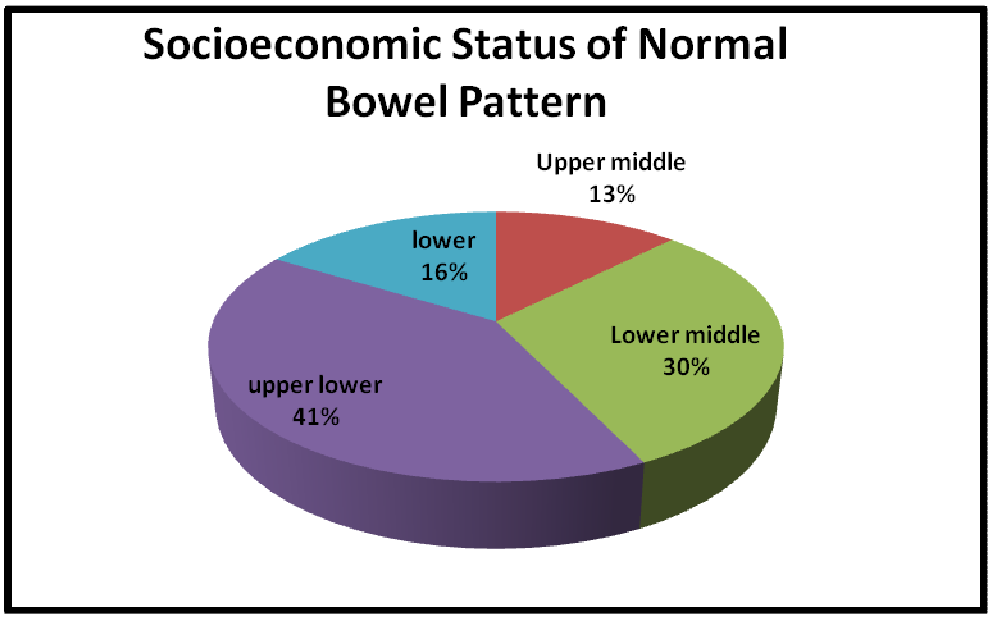


Chart - 7

Most of the children belonged to socioeconomic class upper lower 214 (40.9%). 65 belonged to upper middle class (12.4%), 159 (30.4%) belonged to lower middle class, 85 (16.2%) belonged to lower class. All the children belonged to urban locality.

Bowel habits:

The average number of stools passed per day was 1.14. The predominant stool type passed was type IV n= 259 (49.5%). Type I stool was not seen in any of the children, type II stool was passed by 44 (8.4%), type III stool was passed by 178 (34%), type V stool by 33 (6.3%) number of children. Type VI 3(0.5%) and type VII 5(0.9%).

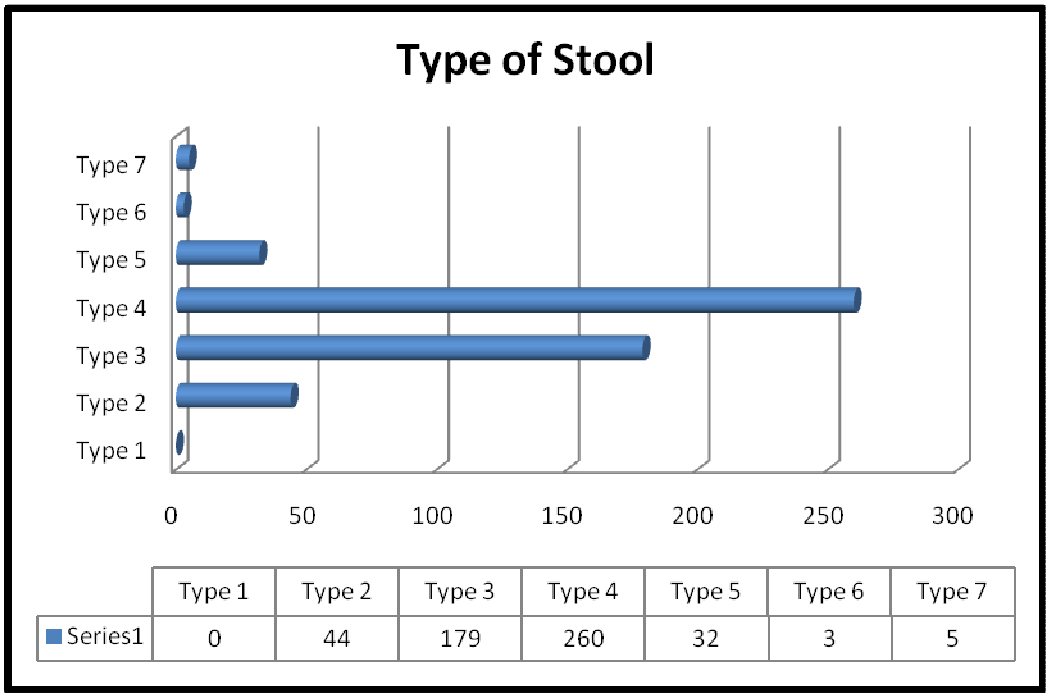


Chart - 8

71 numbers of children had straining at stools with large stools, satisfying the criteria for functional constipation. Out of which 29 children

(40.8%) had type II stools and 37 of them (52.1%) had type III stools. Type IV stools were present for 5 (7%) children.

Toilet was located indoors in 188 (35.9%) and outdoor in 335 (64%) number of houses respectively.

Toilet training was started from an age of 6 months up to 48 months. The average age of toilet training was 27.8 months.

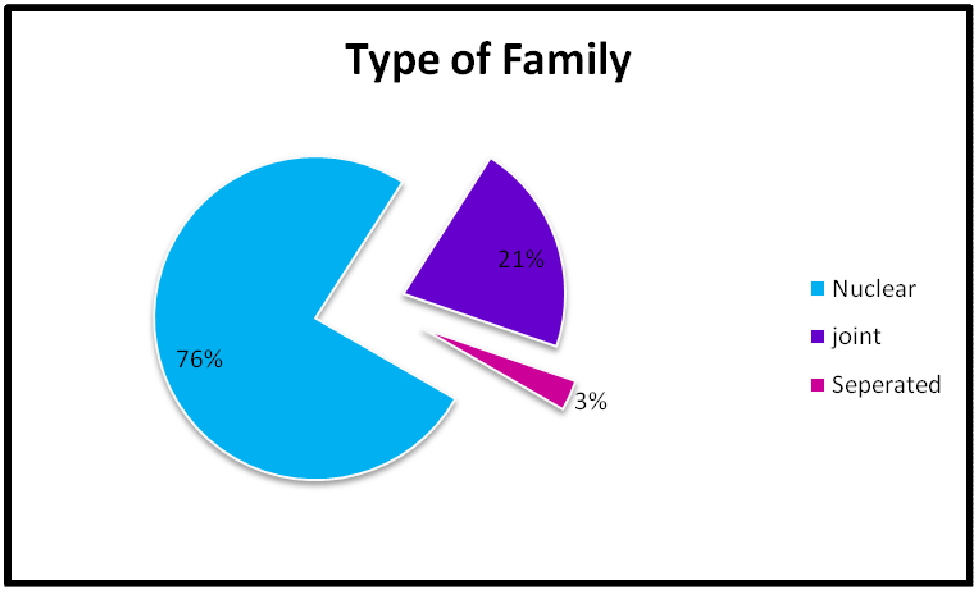


Chart – 9

396 (75.7%) children belonged to nuclear family. 111 (21.2%) belonged to joint family and 16 (3%) were from dysfunctional home.

Table-5: Psychological Precipitants in normal bowel habit group

Precipitants	Percentage (%)
Marital Dysharmony	15.4
Sibling Rivalry	18.7
Temper tantrum	36.3
School phobia	6.5
Aversion to use school toilet	46.2

Marital disharmony and sibling rivalry and tantrum was present in 81 (15.4%), 98 (18.7%), 190 (36.3%) of children respectively. School phobia, unwillingness to use school toilet was found in 34 (6.5%), and 242 (46.2%) of children respectively. The average start to school time was 25 minutes. Working mothers were 122 (23.3%) in this group.

Diet:

The predominant diet was rice based. 489 (93.4%) children had regular breakfast. Vegetable and fruit intake was adequate in 359 (68.6%) and 382 (73%) of children. Both vegetable and fruit intake was adequate in 307 (58.6%) children. Only 60 children did not have junk food. Junk food in the form of fried and baked items were found in 295 (56.4%) and 372 (71.1%) number of children respectively. Milk was consumed by number 476 (90.8%) of children. 69 (13.1%) children had cow's milk.

COMPARISON OF DATA BETWEEN CONSTIPATED AND NORMAL BOWEL PATTERN CHILDREN

Sex of the children with constipation male 92 (45.5%) girls 110 (54.5%) and children with normal bowel habits boys 210 (46.2%) and girls 242 (53.8%) was comparable.

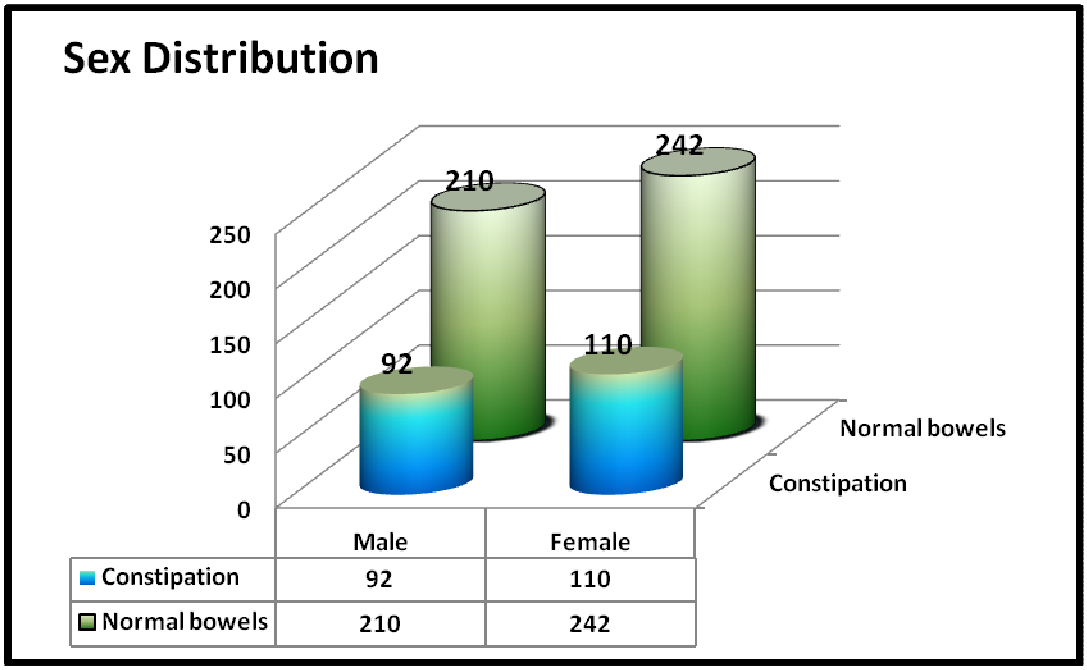


Chart - 10

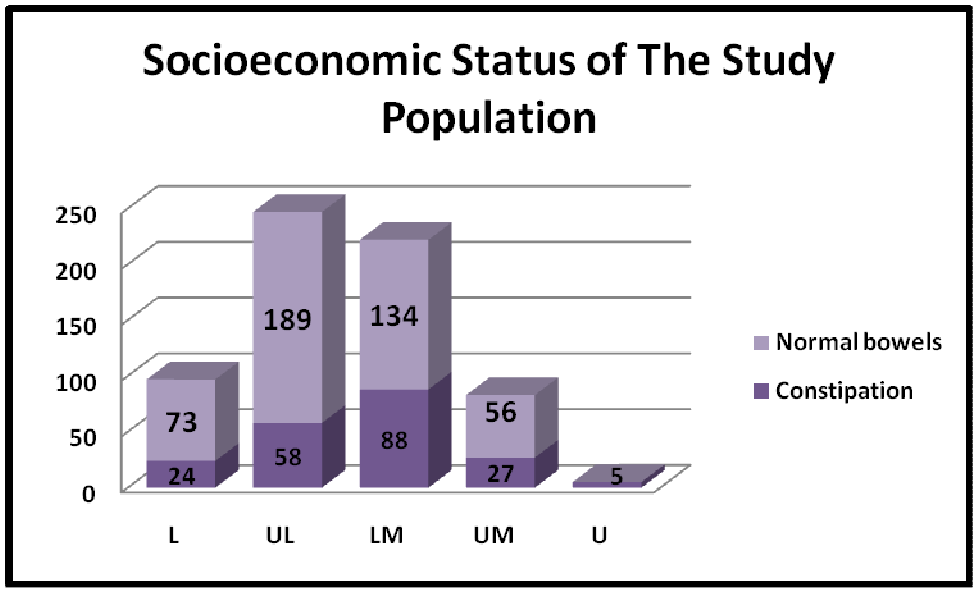


Chart - 11

72% of the children in functional constipation group belonged to social class Lower Middle (LM) and Upper Lower (UL). Similarly 71% of the children with normal bowel habit belonged to the same socioeconomic class. 12% of functional constipation group belonged to lower (L) social class whereas 16% of children with normal bowel pattern belonged to lower social class. In social class Upper Middle (UM) 13% and 12% of functional constipation group and normal bowel pattern group children were distributed respectively. The distribution of children is comparable in both groups.

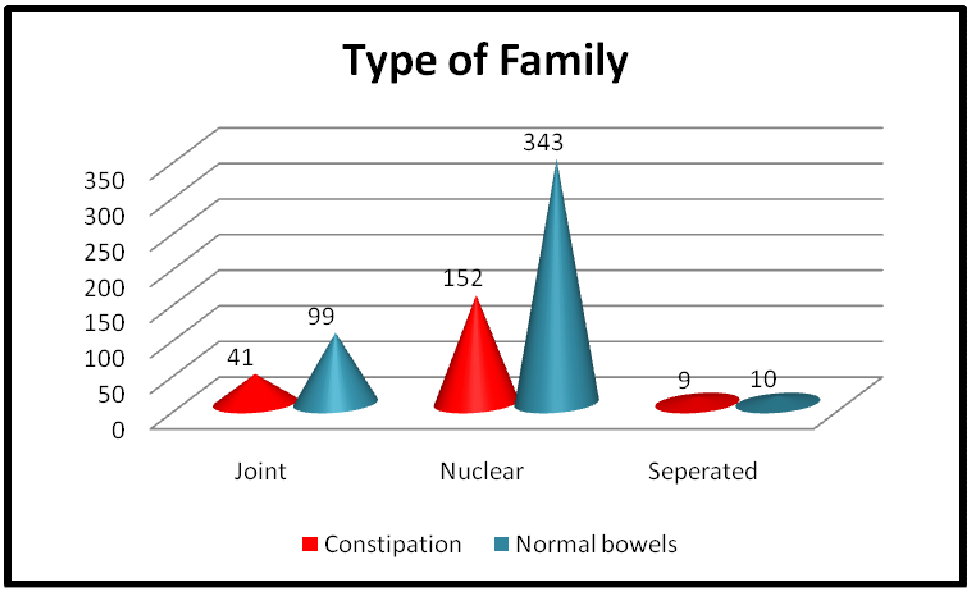


Chart - 12

Out of 140 children from joint family 29.3% had functional constipation and 70.7% did not. Out of the 495 children from nuclear family 30.7% had constipation and percentage of constipation in separated family was 47.5%. There was no statistical significance in the type of family with regards to constipation.

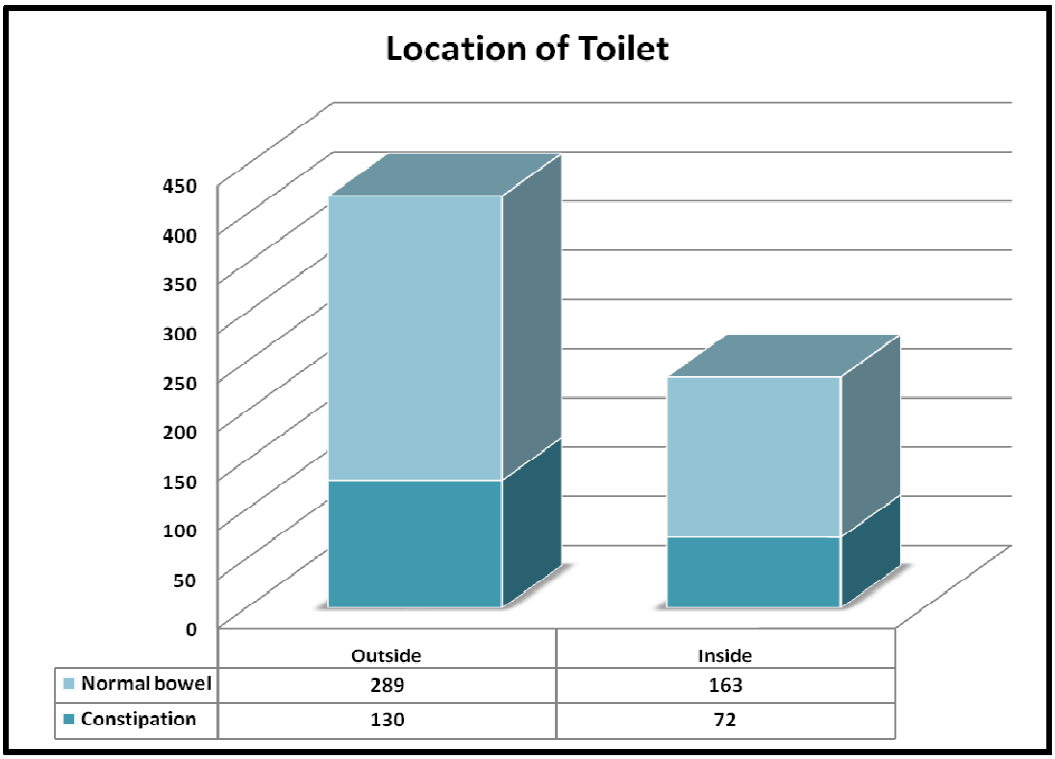


Chart - 13

Location of toilet whether indoor or outdoor did not have significance on childhood constipation with a p value of 0.495, though in the constipation group 64.4% of them had toilet outdoor.

Table-6: Comparison of precipitating factors

Precipitating Factors	Constipation (n = 202)		Normal bowel (n = 452)		P value
	Yes (%)	No (%)	Yes (%)	No (%)	
Marital disharmony	47 (23.2)	155 (76.8)	65 (14.4)	387 (85.6)	0.004
Sibling rivalry	49 (24.3)	153 (75.7)	80 (17.7)	372 (82.3)	0.034
Temper tantrum	121 (59.9)	81 (40.1)	150 (33.2)	302 (66.8)	0.000
School phobia	22 (10.8)	180 (89.2)	25 (5.5)	427 (94.5)	0.001
Aversion to use school toilet	75 (37.1)	127 (62.9)	204 (45.1)	248 (56.9)	0.273
Breakfast skipped	29 (14.5)	173 (85.5)	29 (6.4)	423 (93.6)	0.001

Marital disharmony had an effect on functional constipation with a significant p value of 0.004. When there was no marital disharmony, 71.4% of children passed normal stools. 42% of constipated children were from families with marital disharmony. Temper tantrum had a significant p value in our study. Sibling rivalry was present in 24.3% of constipated children. 82.3% of children with no sibling rivalry passed normal stools. The p value is .034 and statistically significant.16.3% of children in constipated group had school phobia and 93.6% of children with no school phobia had normal

bowel pattern. (p value .001). Unwillingness to use school toilet did not have significance in constipation in our study with a p value of 0.273.Irregular breakfast had an association with constipation. 93.6% of children with regular breakfast had normal stools and 50% of children who skipped or had irregular breakfast had constipation (p value .001).

Working mothers did not have a bearing on functional constipation. Only 26.8% of children with a working mother had constipation and 32.0% of children of home makers had constipation. The p value was 0.135

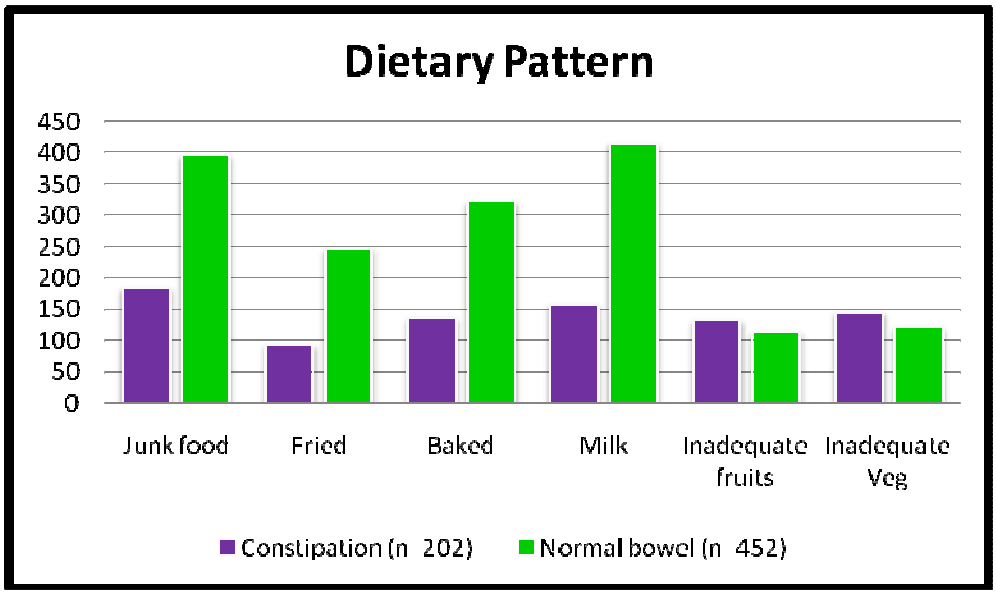


Chart - 14

Consumption of junk food had no statistical significance on constipation neither did baked items. Fried food consumption had significant p value of .030. In all 46.5% of children with constipation had fried snack items and 65.4% of children not having fried item passed normal stools. 83.3% of children having fruits passed normal stools and 65.8% of functional constipation group did not have fruits. This had a statistical significance of .000 p value. Similarly vegetables had a significant p value (.000) in functional constipation. 85.5% of children having vegetables passed normal stools and 72.3% of children in functional constipation group did not have adequate vegetables. Cow's milk had no statistical significance in functional constipation in our study**.**

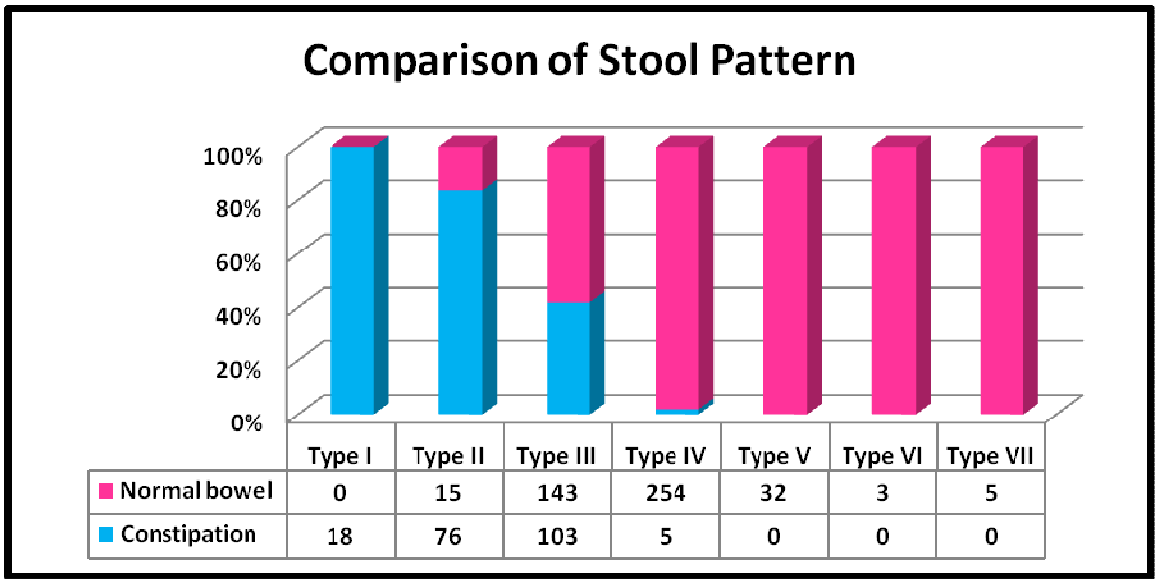


Chart - 15

Type I stool was found only in constipated children. Type V, VI and VII were found only in children with normal bowel pattern. Type II stools were predominantly found in functional constipation group. Type III stools was present in 50.9% of the constipated group and 31.6 % of normal bowel pattern. Type IV pattern was the predominant type of stool in normal bowel habit group.

DISCUSSION

This descriptive observational study was carried out to study the demographic, clinical profile and dietary and other precipitating factors in functional constipation, as well as to find the normal bowel pattern in Southern Indian children from a large tertiary care centre.

The prevalence of functional constipation based on the data from school children in our study were 13.5%, with a slight female preponderance of constipation (54.5%). The prevalence of constipation in school age children from USA was found to be 18% by ***Lorenzo et al;***[21] ***Vera Loening-Baucke et al;***[28] found that the prevalence of constipation was equal in both boys and girls and it was 0.3% to 8% in pediatric population. Similarly ***Iacono et al;***[26] and ***Ciampo D et al;*** [46] found the prevalence of constipation to be equal between girls and boys. ***Ip et al;*** [39] and ***Kajiwara et al;*** [52] found a increased prevalence in girls 32% and 24.2% as compared to boys 21% and 13.2% respectively, similar to our study. ***Kokkonen et al;***[53] too showed more prevalence of constipation in girls. ***Gannikou R et al;*** [64] found a slight male preponderance of constipation with 6.4% of boys being constipated as against 5.7% in girls. ***Khanna et al;*** [37] also showed a male preponderance in functional constipation.

The mean age of the constipated children in our study was 5.18 years which was comparable with the study conducted by ***Kokkonen et al;*** [53] where the mean age was 5.5 years. ***Lorenzo et al;*** [21] study found that peak incidence of constipation occurs at the time of toilet training between 2-4 years of age, with an increased prevalence in boys. In our study also constipation was more common in the age group of 2-4 years (57.25%).

In our study only 32 of the 202 children with functional constipation belonged to upper and upper middle class. The rest belonged to lower socioeconomic strata. This was similar to the systematic review done by ***Peppas***[42] in which constipation was found to be significantly higher in lower social class.

63.4% of children with functional constipation had retentive behavior in the form of abnormal posturing in our study. Boys manifested with this symptom more than girls (56.6%). In the study of ***Khanna et al;*** [37] withholding behavior was seen in 27.4%, which is significantly lesser than that of our study. ***Wald et al;*** [38] found retentive behavior to be more common in boys similar to ours.

In our study fecal soiling was present in 40.4% of children and was equally distributed between both sexes. Fecal soiling was 30.8% in the study

conducted by ***Khanna et al;***[37] In the study by ***Wald et al;*** [38] fecal soiling was more common in boys. Fecal soiling was observed in 84% of children at presentation by ***Voskuijl,***[65] which was very high as compared to our study. ***Kokkonen et al;***[53] also showed a higher prevalence (62%) of fecal soiling in functional constipation.

In our study recurrent abdominal pain was the presenting complaint in 29.7% of children and there was a slight female preponderance. In the study conducted by ***Khanna et al;***[37] 18.8% of children had abdominal pain. This is lower than ours. 26% of functional constipation children had abdominal pain in ***Kokkonen et al;***[53] study comparable to our study.

Blood streaked stools were present in 12.9% of the children with functional Constipation in our study. In the study by ***Weaver et al;***[9] 9% of children had blood streaked stools, similar to ours. In the study of ***Khanna et al;***[37] the prevalence of blood streaked stools was 24.8% almost double our figures.

In our study 2.2% of children with functional constipation had Urinary Tract Infection. In a study by ***Loening- Blaucke*** they found 33% of children with constipation presenting with symptoms of urinary tract infection[66].

Bowel movement per week in our study in the constipated group was 2.5. In ***Khanna et al;*** [37] study the bowel movement per week was 2.8 and was comparable to ours.

Toilet training was started at an average age of 15.5 months in the constipated group as opposed to 27.8 months in children with normal bowel pattern. According to ***Crofffie J***[49] coercive or inappropriate toilet training in a toddler not ready for toilet training may lead to withholding and passage of dry hard stools and painful defecation. ***Bhaskar Raju***[63] in his review article states that the ideal age for toilet training is between 2-3 years. There seems to be relevance in the age of start of toilet training and occurrence of constipation.

Marital disharmony, sibling rivalry and school phobia had significance in functional constipation in our study, but there are no studies to compare these results.

Barbro[40] in her study observed that 63% of school children do not use the school toilet to defecate. 16% of them never urinate and 15% of children always try to avoid using the toilet. So the author feels there is a precarious situation for school children undergoing treatment of bladder and bowel dysfunction. Moreover irregular toilet habits are contributing factors to

functional constipation. In our study there was no significance with regards to aversion to use school toilet. Though 75 (59.9%) of the total 134 children with constipation of school age had aversion to use school toilet.

Irregular breakfast intake had significance in our study with regards to functional constipation. There are no studies regarding this variable on functional constipation.

Cow's milk intolerance can lead on to constipation according to ***Iacono et al;***[25] but ***Simeone et al;***[45] found no relation between cow's milk and constipation. In our present study also there was no significant difference among those who had cow's milk and those who did not.

The fiber intake in our study group was mainly from cereals. Vegetables and fruits intake was low in most children and very low in constipated group with less than one serving per day. 65.8% of constipated group did not have fruit and 72.3% of them did not have vegetables. ***Roma et al;***[67] state that low fiber intake is common in children with chronic constipation. Childhood constipation is much more frequent when dietary fiber intake is restricted according to ***Araujo et al;***[68] ***Ip et al;***[39] found that dietary fiber intake was insufficient in all children and even lower in those with constipation, similar to our study.

In our study the average number of bowel movements per day was 1.14, and predominantly children passed soft stools (type IV of Bristol stool chart) this was comparable to other studies. In the study by ***Wald et al;***[38] found that most children between 5-8 years of age have medium size bowel movement daily or every other day without straining. According to the study done by ***Yong et al;***[61] 96% of school children had a stool frequency between the range of three times a day and once every 2 days. ***Weaver*** and ***Steiner***[9] also found that 96% of 1-4 year old passed stools in the range of three times a day to every other day. At all age children passed soft stool though there was year by year increase in the passage of hard stools. The mean average of stool passed per day for 2 year old was 1.7 and became 1.2 stools per day at 4 years of age.

SUMMARY AND CONCLUSION

- The prevalence of Functional constipation is 13.5% in our study
- Common age of presentation is 2-4 years with an overall female preponderance
- Functional constipation is more common in lower socioeconomic group
- Marital disharmony, sibling rivalry and school phobia have an effect on functional constipation
- Skipping of breakfast and low intake of vegetables and fruits had a significant influence on functional constipation
- Early toilet training is associated with development of constipation
- The average number of stool passed per day by children with normal bowel habit is 1.14 and it is mostly of soft consistency

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Annexure-I

Proforma for normal bowel pattern in children

Name:

Age/Sex:

Address:

Socioeconomic status :

Mother's education:

Working mother / Home maker

Father's education:

Income:

Family: Nuclear/ Joint/ Separated

Type of house : Hut/ Asbestos sheet/ Concrete

Type of toilet: Indian/ Western/ Open

Location of toilet : Inside / outside the house

Bowel movements: Morning / Evening / Night

Number of bowel movements per week:

Consistency of stools: Type _____ (Refer the chart enclosed)

Straining: Yes / No

Toilet training started at:

Temper tantrums: Yes / No

Recurrent headache: Yes / No

Continence achieved: Yes / No

Order of pregnancy:

Marital dysharmony: Yes / No

Single parent / Divorcee / Living separately

Sibling rivalry: Yes / No

School phobia / avoidance: Yes / No

School timing:

Start to school time:

Breakfast: At home/ At school/ Skipped

Use of school toilet: Comfortable/ Not comfortable

Type of toilet at school: Indian/ Western

Adequacy of toilet: Yes / No

Water for ablution: Yes/ No

Canteen available: Yes / No

Type of snacks sold in canteen: Yes / No

Scholastic performance:

Annexure-II

PROFORMA FOR FUNCTIONAL CONSTIPATION

Name:

Age/Sex: Height : cm Weight : Kg

Address:

Type of toilet: Western toilet / Indian toilet / Open field

Location of toilet: Inside / Outside

Complaints:

Duration:

Blood streaking of stools:

Fecal soiling:

Frequency of stools per week:

Consistency of stool:

Straining:

Recurrent abdominal pain:

Urinary symptoms:

GERD symptoms:

Bowel movements: Morning/ Evening/ Night

Abnormal posturing: Clenching teeth

Crossing legs

Squeezing buttocks together

Duration in toilet:

Faecal soiling: Yes/No

Mass descending per rectum: Yes/No

H/O digital evacuation: Yes/No

Precipitating factors:

Toilet training started at:

Temper tantrums: Yes / No

Recurrent headache: Yes / No

Continence achieved: Yes/No

Order of pregnancy:

Marital dysharmony: Yes / No

Single parent / Divorcee / Living separately

Sibling rivalry: Yes / No

School phobia/ avoidance: Yes / No

School timing:

Start to school time:

Breakfast: At home / At school/ Skipped

Use of school toilet: Comfortable/ Not comfortable

Type of toilet at school: Indian/ Western

Scholastic performance:

Past history

History of surgery:

History of drug intake:

History thyroid medications

Birth history

Meconium passed at:

Development: Delayed/Normal

Dietary history

Infants: Breast feed/ Formula feed

Older children: (To fill diet sheet)

Socioeconomic status:

Mother's education:

Working mother / Home maker

Father's education:

Income:

Housing type:

Nuclear or joint family:

General physical Examination

Anemia

Ictreus

Lymphadenopaty

Cyanosis

Clubbing

Others

Vital signs

Temperature:

Pulse rate:

Respiratory rate:

Blood pressure:

Systemic examination

Abdomen:

CVS:

RS:

CNS

Local examination

Anal opening:

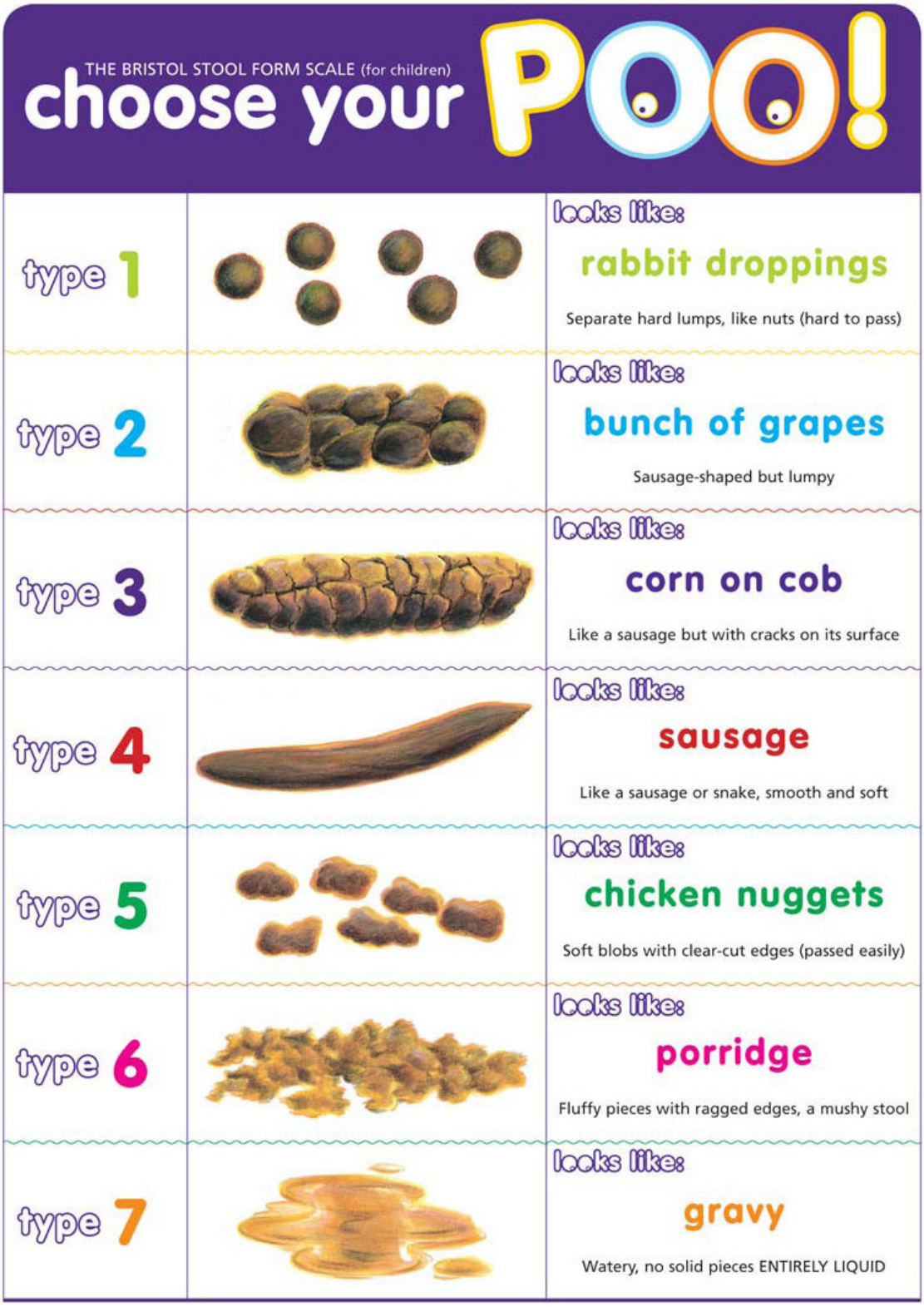
Perianal area:

Fissure:

Pilonidal sinus:

Per rectum examination:

Annexure - III



Annexure -IV

DIET RECORD

Day	**Breakfast**	**Lunch**	**Evening snacks**	**Dinner**	**Fruits**	**Milk(Aavin /cow's milk)**	**Number of glasses of water**	**Toilet passed**
Monday								
Tuesday								
Wednesday								
Thursday								
Friday								
Saturday								
Sunday								